Westview High School HVAC System Review

Prepared For

Tolleson Union High School District #214

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LSW Project No. 2012-067.001

July 25, 2012

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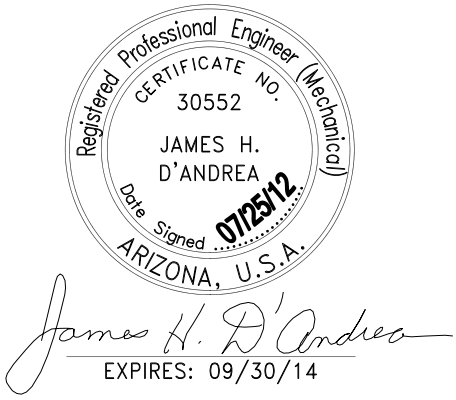


I. Introduction

Westview High School located in Avondale, Arizona was completed and first opened in 1990. Since that time there have been several phases of expansion with the last major expansion phase occurring in 2000.

The HVAC system serving the majority of the high school campus buildings is a Variable Volume / Variable Temperature (VVT) system which consists of packaged rooftop HVAC heat pump units, electrically actuated variable volume boxes serving the building spaces and bypass dampers that are used to control supply duct static pressure. Each variable volume box modulates its volume control damper in response to its respective zone thermostat or sensor. Air not used by the spaces is bypassed into the return air ceiling plenum. Thus, the zone air flow is variable but the rooftop HVAC unit air flow is constant. The installed VVT system is designed to provide all cooling and heating capacity centrally. When all zones require some degree of cooling, the main HVAC unit remains in the cooling mode. When all zones require some degree of heating, the main HVAC unit remains in the heating mode. When both heating and cooling are required simultaneously, the electronic controls determine the greatest need (heating or cooling) and they first satisfy that need. Once the greatest need is addressed, the main HVAC unit will then switch to the opposite mode. The system will continue switching between cooling mode and heating mode in order to satisfy all zones. This system was mainly developed for small to medium sized commercial buildings and it not commonly found in school classroom buildings.

The existing controls for the campus HVAC systems are Alerton IBEX DDC controls that are the older version of the Alerton DDC controls which utilize a proprietary communication protocol.

Facilities staff has reported the following system deficiencies:

1. There are approximately 11 rooftop heat pump units that are considered to be in need of replacement. Most of these units have required on-going maintenance.

2. The existing HVAC control system has experienced numerous failures of the control damper actuators and some DDC controllers resulting in inadequate temperature space temperature control in numerous building spaces. At the same time, the district is planning a district wide controls integration project that will allow monitoring and control of all schools from a central location at the district facilities office. The existing Alerton IBEX system at Westview HS does not currently have the ability to be monitored at the district facilities office and would require significant upgrade to have that capability.

The purpose of this study was as follows:

1. Review the age and observed operating condition of the subject equipment and controls.
2. Provide recommendations to address any found deficiencies associated with the subject HVAC equipment and controls.
3. Provide estimations of construction costs for implementation of any recommended measures.

Information contained in this report was obtained from interviews with facility staff, review of available record drawings, coordination with industry vendors, physical observation of existing equipment, and preliminary calculations for equipment sizing.

II. Findings and Observations

Existing Heat Pump Units

Eleven existing rooftop HVAC pump units were identified by facilities staff as needing replacement. Information covering these units is summarized in Table I (see appendix). Following is a summary of our findings:

Gymnasium

RTU #7 This packaged rooftop cooling / gas heating unit was manufactured in 2003. Unit serves girls locker room and restroom areas. Record drawings were not available to determine when unit was actually placed into service. Facilities staff reports that there are no current operational issues with this unit. Based upon physical observation of unit, it appears to be in fair to good operating condition. We estimate the remaining useful life to be approximately 2 – 5 years.

RTU #8 This packaged rooftop cooling / gas heating unit was manufactured in 2003. Unit serves boys locker and restroom areas. Record drawings were not available to determine when unit was actually placed into service. Facilities staff reports that there are no current operational issues with this unit. Based upon physical observation of unit, it appears to be in fair to good operating condition. We estimate the remaining useful life to be approximately 2 – 5 years.

RTU #9 This packaged rooftop cooling / gas heating unit was manufactured in 2004. Unit serves wrestling room. Some record drawings were available and it appears the unit was placed into service in 2005. Facilities staff reports that there are no current operational issues with this unit. Based upon physical observation of unit, it appears to be in fair to good operating condition. We estimate the remaining useful life to be approximately 3 – 6 years.

RTU #10 This packaged rooftop cooling / gas heating unit was manufactured in 2005. Unit serves wrestling room. Some record drawings were available and it appears the unit was placed into service in 2005. Facilities staff reports that there are no current operational issues with this unit. Based upon physical observation of unit, it appears to be in fair to good operating condition. We estimate the remaining useful life to be approximately 3 – 6 years.

Administration

RTU #3 This packaged rooftop heat pump unit was manufactured in 1994. Unit serves an IT equipment room. Record drawings were not available to determine when unit was actually placed into service. Facilities staff reports that there are no current operational issues with this unit but there have been repairs made in the past. Based upon physical observation of unit, it appears to be in fair to poor operating condition. We feel that this unit is at or very near the end of its useful life.

ROTC

RTU #3 This packaged rooftop heat pump unit was manufactured in 1993. Record drawings were not available to determine when unit was actually placed into service or exact spaces served. Facilities staff reports that there are no current operational issues with this unit but there have been repairs made in the past. Based upon physical observation of unit, it appears to be in fair to poor operating condition. We feel that this unit is at or very near the end of its useful life.

RTU #4 This packaged rooftop heat pump unit was manufactured in 1993. Record drawings were not available to determine when unit was actually placed into service or exact spaces served. Facilities staff reports that there are no current operational issues with this unit but there have been repairs made in the past. Based upon physical observation of unit, it appears to be in fair to poor operating condition. We feel that this unit is at or very near the end of its useful life.

RTU #5 This packaged rooftop heat pump unit was manufactured in 1993. Record drawings were not available to determine when unit was actually placed into service or exact spaces served. Facilities staff reports that there are no current operational issues with this unit but there have been repairs made in the past. Based upon physical observation of unit, it appears to be in fair to poor operating condition. We feel that this unit is at or very near the end of its useful life.

Performing Arts

RTU #1: This packaged rooftop cooling / electric heating unit was manufactured and placed into operation in 2000. Unit serves the main auditorium seating area. Unit was found in non-operating condition with missing parts including condenser fans. Facilities staff reported that compressors and blower motor have failed. Temporary cooling measures have been implemented to keep the space functional when the auditorium area is needed. Without operation of this unit, the auditorium space is not being properly ventilated when occupied. Unit is in need of immediate replacement.

RTU #2 This packaged rooftop heat pump unit was manufactured and placed into operation in 2000. Unit serves Stage Craft area. Facilities staff reports that there are no current operational issues with this unit but there have been repairs made in the past. Based upon physical observation of unit, it appears to be in fair operating condition. We estimate the remaining useful life to be approximately 1 – 3 years.

RTU #3 This packaged rooftop heat pump unit was manufactured and placed into operation in 2000. Unit serves Stage Craft area. Facilities staff reports that there are no current operational issues with this unit but there have been repairs made in the past. Based upon physical observation of unit, it appears to be in fair operating condition. We estimate the remaining useful life to be approximately 1 – 3 years.

Existing HVAC Control System

The existing HVAC control system is manufactured by Alerton. The system is the Alerton “IBEX” system which is the older, proprietary version of the Alerton line of Direct Digital Controls (DDC). As the campus was constructed in phases between approximately 1990 and 2000, many portions of this system are approximately 22 years old and the newest portions of this system are approximately 12 years old. Due to advances in the industry and evolution of the controls industry, this system is now obsolete and production of replacement parts was discontinued in 2010. As such, inventories of available replacement parts are rapidly dwindling and will not be available at all in the very near future. If the existing Alerton system is to be retained, an upgrade to Alerton's Envision for BACtalk must be performed to convert the proprietary IBEX system to an industry standard BACnet system. A BACtalk upgrade for this system requires new software and global controllers and would allow all existing and operable IBEX unitary controllers to remain in place. Existing IBEX controllers could then be gradually replaced with BACtalk controllers as they fail, to transition into a new BACnet based system.

Maintenance staff has reported that numerous control damper actuator failures have occurred. In addition, some of the existing unitary DDC controllers have also begun to fail. Since the age of these actuators and controllers is in the range of 12-22 years, this is not uncommon or unexpected. Typically, we would expect that the useful life of the control system would be approximately 15-20 years. Based upon this alone, portions of the existing system are already at or beyond their anticipated useful life.

Currently, the control and monitoring of this system has to be done at the Westview High School site via an existing workstation that is antiquated and has limited graphic capabilities. A separate district wide integration project is currently underway to allow monitoring of all the individual high school sites in the district from the main district facilities office located at 9701 West Van Buren in Tolleson, AZ. Because the existing Alerton IBEX system utilizes a proprietary communication protocol, integration of the Westview control system cannot be done unless the existing Alerton system is upgraded to the Alerton BacTalk system or replaced with a new system that utilizes a non-proprietary protocol.

III. Recommendations

Existing Heat Pump Units

Recommended replacement schedules are provided for each unit based upon age, observed condition and reported deficiencies. Table 2 (see appendix) provides a suggested replacement unit equipment schedule for all units.

Gymnasium

RTU #7 Replace unit within the next 2-5 years. Replacement shall include new electric cooling / gas heating packaged rooftop unit complete with new roof curb adaptor, gas piping, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $25,000.

RTU #8 Replace unit within the next 2-5 years. Replacement shall include new electric cooling / gas heating packaged rooftop unit complete with new roof curb adaptor, gas piping, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $25,000.

RTU #9 Replace unit within the next 3-6 years. Replacement shall include new electric cooling / gas heating packaged rooftop unit complete with new roof curb adaptor, gas piping, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $15,000.

RTU #10 Replace unit within the next 3-6 years. Replacement shall include new electric cooling / gas heating packaged rooftop unit complete with new roof curb adaptor, gas piping, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $10,000.

Administration Building

RTU #3 Replace unit within the next year. Replacement shall include new packaged rooftop heat pump unit complete with new roof curb adaptor, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $5,000.

ROTC

RTU #3 Replace unit within the next year. Replacement shall include new packaged rooftop heat pump unit complete with new roof curb adaptor, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $10,000.

RTU #4 Replace unit within the next year. Replacement shall include new packaged rooftop heat pump unit complete with new roof curb adaptor, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $5,000.

RTU #5 Replace unit within the next year. Replacement shall include new packaged rooftop heat pump unit complete with new roof curb adaptor, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $6,000.

Performing Arts

RTU #1: Replace unit immediately. Replacement shall include new packaged rooftop cooling / electric heating unit complete with new roof curb adaptor, controls, electrical, as required. Modifications to the existing roof mounted ductwork will be required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $60,000.

RTU #2 Replace unit within the next 1-3 years. Replacement shall include new packaged rooftop heat pump unit complete with new roof curb adaptor, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $15,000.

RTU #3 Replace unit within the next 1-3 years. Replacement shall include new packaged rooftop heat pump unit complete with new roof curb adaptor, controls, electrical, as required. No modifications to the roof structure are anticipated as the replacement unit would be of the same or less weight than the existing unit.

Estimated Construction Cost: $15,000.

Existing HVAC Control System

There is an immediate need to replace numerous damper actuators that have failed. Since a significant amount of these dampers are 20 years old or older, we recommend that they all be replaced as soon as possible. As previously mentioned the existing DDC control system utilizes a proprietary communication protocol and unless it is replaced with a new system or upgraded with current Alerton Bacnet products, integrating it into the new Honeywell control system that is part of the new district wide integration project would be extremely difficult if not impossible. The majority of existing Alerton DDC unitary controllers are also 20 years old or older and have also experienced some failures. Production of the IBEX controllers was discontinued in 2010 and availability of replacement controllers is already limited. Based upon the above information, we feel that there are two options as follows:

Option 1 – Upgrade Existing Alerton System

Estimated Construction Cost: $150,000.

This option consists of the following:

- Replacing all existing damper actuators.
- Upgrading the existing Alerton IBEX system to the new Alerton BacTalk system. This would require installation of new global controllers and power supplies and would allow integration into the new district wide Honeywell control system.
- Retaining the existing proprietary unitary controllers. As the unitary controllers fail, they would be replaced with the new Alerton BacTalk unitary controllers.
- Retaining all existing wiring, thermostats, etc.

Option 2 – Replace Existing Alerton System

Estimated Cost: $300,000.

This option consists of the following:

- Replacing the entire control system including actuators, wiring, controllers, thermostats, sensors, commissioning, etc. with a new Bacnet compatible control system.

In reviewing the two above options, Option 2 is the recommended choice for the following reasons:

- Option 1 includes the reuse of existing unitary controllers, wiring, thermostats, sensors, etc. which will continue to require replacement, repair and on-going maintenance as they continue to age. We anticipate that over the course of the next 1-5 years, a significant amount of the existing unitary controllers and miscellaneous control devices such as sensors and thermostats will likely need to be replaced. This will result in continued and increasing maintenance costs and temperature control issues as the system reaches the end of its useful life.

- Option 2 provides the district with a totally new system that is fully tested and commissioned. The system will come with a 1-2 year warranty and will provide state-of-the-art technology. The overall HVAC system performance will be improved and maintenance costs significantly reduced. The new system could be competitively bid resulting in the best available pricing.

End of report

IV. Appendices

Table 1 - Westview High School Existing HVAC Equipment Schedule										
HVAC Unit Identification	**Building Served**	**Area Served**	**Manuf.**	**Unit Type**	**Model Number**	**Serial Number**	**Date of Manuf.**	**Nom. Cap. (Tons)**	**Efficiency**	**Weight (LBS)**
RTU #7	Gymnasium	Girls Locker	Carrier	Gaspack	48HGD014A-601-SQ	0403F13037	2003	12.5	11.6 EER	2102
RTU #8	Gymnasium	Boys Locker	Carrier	Gaspack	48HGD014A-601-SQ	0403F13038	2003	12.5	11.6 EER	2102
RTU #9	Gymnasium	Wrestling Room	Carrier	Gaspack	50HJQ008-621	4904G50696	2004	7.5	10.3 EER	940
RTU #10	Gymnasium	Westling Room	Carrier	Gaspack	50HJQ006-621	0305G20108	2005	5	13.0 SEER	550
RTU #3	Administration	IT Room	Trane	Heat Pump	WCY024F100AD	N296Y851H	1994	2	10 SEER	331
RTU #3	ROTC	Office	Trane	Heat Pump	WCC060F400BB	K273XX12H	1993	5	10.0 SEER	539
RTU #4	ROTC	Office	Trane	Heat Pump	WCC018F100BB	K256SSL2H	1993	1.5	10.0 SEER	280
RTU #5	ROTC	Office	Trane	Heat Pump	WCC030F100BB	K2941WG1H	1993	2.5	10.0 SEER	336
RTU #1	Performing Arts	Auditorium	Carrier	AC / Electric Heat	50EWC030-610 PA	0400F75268	2000	27.5	8.8 EER	4751
RTU #2	Performing Arts	Stage Craft	Carrier	Heat Pump	50TJQ008-601	0400G30338	2000	7.5	10.3 EER	940
RTU #3	Performing Arts	Drama Room	Carrier	Heat Pump	50TJQ008-601	0400G30337	2000	7.5	10.3 EER	940

Table 2 - Westview High School HVAC Equipment Replacement Schedule							
HVAC Unit Identifcation	**Building Served**	**Area Served**	**Manuf.**	**Model Number**	**Nominal Cap. (Tons)**	**Efficiency**	**Weight**
RTU #7	Gymnasium	Girls Locker	Carrier	48HCD	12.5	12.2 EER	1540
RTU #8	Gymnasium	Boys Locker	Carrier	48HCD	12.5	12.2 EER	1540
RTU #9	Gymnasium	Wrestling Room	Carrier	50 HCQ	7.5	12.1 EER	958
RTU #10	Gymnasium	Westling Room	Carrier	50 HCQ	5	15.0 SEER	933
RTU #3	Administration	IT Room	Carrier	50EZ	2	13.5 SEER	639
RTU #3	ROTC	Office	Carrier	50HCQ	5	15 SEER	659
RTU #4	ROTC	Office	Carrier	50EZ	2	13.5 SEER	327
RTU #5	ROTC	Office	Carrier	50EZ	2.5	13.5 SEER	340
RTU #1	Performing Arts	Auditorium	Carrier	50A	27.5	10.1 EER	4384
RTU #2	Performing Arts	Stage Craft	Carrier	50 HCQ	7.5	12.1 EER	933
RTU #3	Performing Arts	Drama Room	Carrier	50 HCQ	7.5	12.1 EER	933


ROTC Building
RTU-4
RTU-3
3


RTU-3
ROTC Building
3


ROTC Building
RTU-4
4


ROTC Building
RTU-4
R22
4


ROTC Building
RTU-5
5


ROTC Building
RTU-5
5


Gymnasium
RTU-7


Gymnasium
RTU-7


Gymnasium
RTU-8
R22


Gymnasium
RTU-9

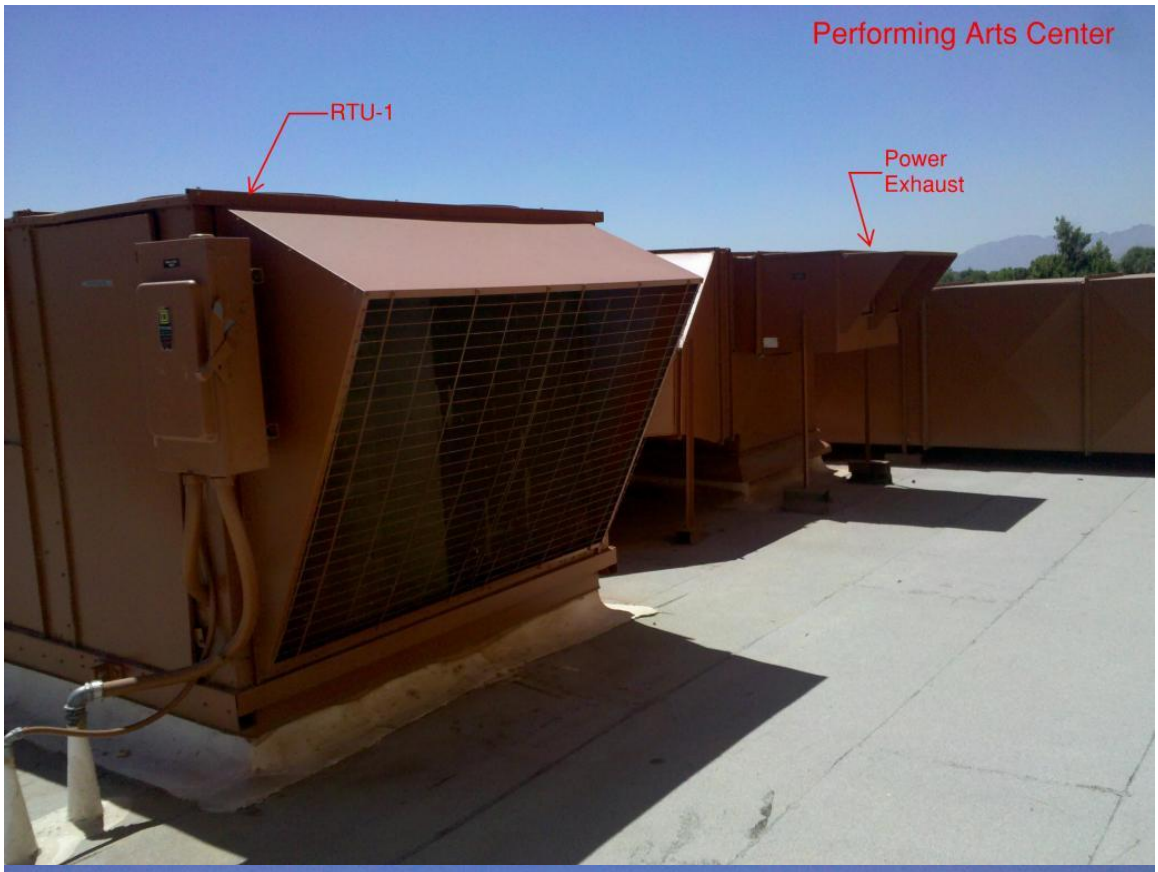

Gymnasium
RTU-9


Gymnasium
RTU-10
10
10


RTU-10
Gymnasium
10


Administration Building
RTU-3
3


Administration Building
RTU-3
American Standard
3


Performing Arts Center
RTU-1
Power
Exhaust


Performing Arts Center
RTU-1
RTU-2


Performing Arts Center
RTU-2


Performing Arts Center
RTU-3


Performing Arts Center
Missing
Condenser
Fans
RTU-1